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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 :
A63H 33/08, 17/26

A1

(11) International Publication Number: WO 93/08887

(43) International Publication Date: 13 May 1993 (13.05.93)

(21) International Application Number: PCT/DK92/00321

(22) International Filing Date: 5 November 1992 (05.11.92)

(30) Priority data:
1830/91 6 November 1991 (06.11.91) DK

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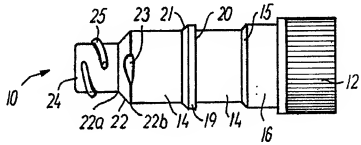
(81) Designated States: AT, AU, BB, BG, BR, CA, CH, CS, DE, DK, ES, FI, GB, HU, JP, KP, KR, LK, LU, MG, MN, MW, NL, NO, PL, RO, RU, SD, SE, UA, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG).

Published
With international search report.

(54) Title: A SCREW FOR A TOY BUILDING SET



(57) Abstract

A screw for a toy building set has a shank with a threaded section for screwing into another of the elements of the toy building set with a preformed threaded hole. The screw is adapted to resist forces acting transversely to the shank of the screw at a distance from the element. In elongation of the threaded section the screw has an engagement area by which the screw, when screwed in, engages a complementary engagement area on the other toy building set element formed with the threaded hole. The screw is thus supported in an area which is positioned at a greater radial distance from the longitudinal axis of the screw than the radius of the threaded section.

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A screw for a toy building set

The invention concerns a screw for a toy building set and comprising a shank with threads for screwing into another of the elements of the toy building set with a preformed threaded hole, so that the screw is capable of resisting a force acting transversely to the shank of the screw at a distance from the element.

It is known from toy building sets of the construction type to screw elements together. Thus, there are examples that, in addition to ordinary coupling means, such as coupling studs and complementary receiving means, elements subjected to special loads are also coupled together by means of screws constructed for the purpose. These screws are screwed into special, preformed threaded holes in others of the building elements of the toy building set. It is also known to use screws for securing wheels to vehicle bottoms built with the elements of the toy building set. The mutual intensified attachment of the elements takes place in a fully satisfactory manner as far as it goes. Such a load is absorbed in the screw in its longitudinal direction, and the tension absorbing properties of the screw are fully satisfactory. Such a screw is known e.g. from the US Patent Specification 4 551 110.

The Danish Patent Application 872/89 discloses a screw which blocks the flexible properties of an element. Here too, the tension is applied to the screw in the longitudinal direction.

However, screws loaded transversely to the longitudinal direction of the shank have a significant weakness. The diameter of the threaded section of the screw is deter-

mined by the dimensions of the element into which the screw is inserted. With respect to the overall structure the dimensions of this element are often to be minimized, so that the diameter of the threaded section is likewise minimized. The moment of force on the screw is determined partly by the size of the transverse component of the force acting on the screw, partly by the distance between the point of application of the force and the contact point of the shank with the element (the arm on which the force acts) in which the screw is secured. With the requirement of a small threaded section diameter screws used e.g. as wheel shafts will tend to break in the area positioned around the surface of the element when the screw is subjected either to great static loads or by pulse impacts e.g. when being dropped. A corresponding problem will be present if the screw is used for transferring forces in the transverse direction of the screw.

The object of the invention is therefore to provide a screw for a toy building set, said screw being constructed such that it is better capable of resisting forces acting transversely to the longitudinal direction of the screw and at a distance from that of the elements of the toy building set in which the screw is placed in a preformed threaded hole.

This object is achieved as stated in the characterizing portion of claim 1, since the location of the engagement area - at a greater radial distance than the radius of the threaded section - entails that the resulting moment of force is reduced because the resulting arm is smaller.

In a preferred embodiment the engagement area consists of a conical engagement face on the screw. The conical engagement face can advantageously be caused to engage a corresponding conical engagement face on the element in

which the screw is placed. The conical engagement face on the screw can advantageously form a transition between the small diameter of the threaded section and a shank section having a diameter greater than said diameter. This is expedient in particular if the latter is not subject to any diameter restrictions.

Two complementary, conical engagement areas on the screw and the building element, respectively, will usually be preferable, but the engagement area may e.g. be ring-shaped and provided in that the screw is formed with a stepwise expansion. With most plastics materials such sharp edges on plastics structures entail that the structure will have a weakening - notch effect - in the area around the sharp edge. The conical engagement face is therefore preferred in practice.

Since the toy building set in the preferred embodiment is usually produced by plastics injection moulding, the pitch of the threads will typically be relatively great, so that the engagement faces can advantageously be formed with complementary depressions and projections, such that the screw is retained in its inserted position when the depressions and the projections are engaged. This is expedient in particular when the screw is used is a wheel shaft, since the screw, depending on the vehicle side in which it is positioned, will be subjected to a force originating from friction with the hub of the wheel, otherwise entailing that the screw will be loosened or tightened. This is obviated with the complementary depressions and projections which are described above. The projection may expediently be shaped as a round knob. The depression can be formed asymmetrically with a steep stop face and an inclined guide face. Sufficient retention of the screw can be achieved by these features, even if the threads on it are just formed by about one convolution. The screw can

hereby be manufactured by injection moulding using simple tools.

The invention will be described more fully below in connection with preferred embodiments and with reference to the drawing, in which

fig. 1 is a side view of a preferred embodiment of a screw according to the invention for use in a toy building set,

fig. 2 is a schematic view of the coupling between a screw and a threaded hole for the screw shown in fig. 1,

fig. 3 is a schematic view of the coupling between a screw and a threaded hole for a first alternative embodiment of a screw according to the invention,

fig. 4 is a schematic view of the coupling between a screw and a threaded hole for a second alternative embodiment of a screw according to the invention,

fig. 5 is a schematic view of the coupling between a screw and a threaded hole for a third alternative embodiment of a screw according to the invention,

fig. 6 is a schematic view of the coupling between a screw and a threaded hole for a fourth alternative embodiment of a screw according to the invention,

fig. 7 is a perspective view showing how a screw according to the invention together with a wheel hub is placed in another of the building elements of the toy building set, and

fig. 8 is a schematic view of an alternative arrangement of the interlocking of the screw according to the inven-

tion and the threaded hole.

Fig. 1 shows a screw according to the invention. It comprises a screw head 12 with a shank having a threaded section 24 with one thread 25 at the end facing away from the screw head 12. The threaded section 24 terminates downwardly in a conical section 22 which is formed with two diametrically positioned locking holes 23. The conical section 22 constitutes a borderline section between the threaded section 24 having a relatively small diameter and the rest of the screw shank having a greater diameter. The screw 10 of the invention is preferably manufactured by plastics injection moulding and it is therefore usually hollow. The shank section 14 of the screw between the head 12 and the conical face 22 thus has a greater diameter than the threaded section 24. The shank section 14 has an annular bead 19 which is formed with a guide face 21 and a stop face 20. In a preferred embodiment the shank 14 merges into a shank section 16 via a conical guide face 15, the shank section 16 having the same diameter as the bead 19.

Since the screw 10 has the shape shown in fig. 1, a hub 40, shown in fig. 7, can be received and rotatably secured on the shank portion 14 positioned between the bead 19 and the head 12. The guide face 21 permits such reception, while the blocking face 20 prevents removal of the hub 40 again. The guide face 15 and the shank section 14 correspond to the hole in the hub 40, and the complementary guide face (not shown) of the hole can advantageously be recessed with respect to the outer side of the hub to provide a better guide between the parts during the assembling process.

The head 12 on the screw 10 preferably has longitudinal grooves so that the screw will have a better finger grip

when the screw 10 is to be screwed into another element. As appears from fig. 7, the end face 11 of the screw head 12 may be formed with an opening which is adapted to receive a specially constructed tool by means of which the screw can be tightened. It is shown in fig. 7 how the screw is adapted to be received in a threaded hole 35 on another element 30 incorporated in the toy building set, said threaded hole 35 having a conical section which is complementary to the conical section 22 of the screw, and which is formed with two diametrically positioned locking bosses 37. These locking bosses are adapted to be received in the locking holes 23 of the screw. The locking bosses 37 are preferably in the form of small rotational-symmetric knobs, while the holes 23 will be asymmetric. The holes will thus have a guide face serving to guide the locking bosses 37 into engagement, and a stop face counteracting further tightening. This is possible i.a. because the materials are flexible, and because the thread 25 has a great pitch. It will be clear to a skilled person that it will also be possible to provide the screw with locking bosses, while the conical section 36 on the toy building element 30 is then provided with complementary locking holes.

It will be appreciated that the screw can be used for other purposes than precisely as a shaft for a wheel, but the principles of the invention are presumably best illustrated in that connection. A vehicle built with the toy building set may be considered as being bodies consisting of several individual subbodies. These subbodies may e.g. consist of the actual vehicle bottom with a superstructure as well as each of the four wheels. When the overall body is subjected to a load e.g. caused by a drop, torsional forces will occur between the subbodies incorporated in the body. During the drop loading these forces are converted to moments acting between the subbodies. The mo-

ments depend partly on the size of the forces, partly on the arm on which the forces act. Since the engagement area of the screw (the conical section 22 in fig. 1) is positioned at a greater radial distance from the longitudinal axis of the screw than the radius of the threaded section 24, the point of application of the force will be moved from the termination 22a of the threaded section to the transition 22b between the conical area 22 and the shank section 14. The size of the arm on which the force acts will be reduced hereby, while the point of application 22b will transform a bending force acting in the transverse direction of the screw 10 at a distance form the building element 30 to a tensile force acting in the longitudinal direction of the screw.

Fig. 2 shows a preferred embodiment of the screw of the invention, where a conical engagement area 22 is provided between the threaded section 24 of the screw and the rest of the shank 14 of the screw. The screw is screwed into the element 30 and thus received and retained in the threaded hole 35 and the threaded coupling 42. Since two complementary conical sections 22 and 36 are involved, the engagement area of the screw will likewise be a continuous conical face. In practice, however, there will often be a gap between the two faces, but owing to the flexibility of the screw the faces 22 and 36 will be pressed together under external, mechanical forces.

Fig. 3 shows another embodiment of a screw according to the invention, where the screw via its threaded section 24 is threadedly coupled with the threaded section of the screw hole 35. It will be seen that the shank 14 of the screw has the same diameter as the threaded section 24 of the screw. Relief takes place here through a bead 41 with conical faces, the engagement face 22 being one of these. The threaded hole on the element 30 terminates in a step-

wise expansion, so that the engagement face here is just formed by a ring-shaped contact line 37. This embodiment provides substantially the same technical effect as the embodiment shown in fig. 2, since the point of application 22b will be positioned on the contact line 37.

The structure shown in fig. 4 may be considered as being complementary to the structure shown in fig. 3, since the threaded hole 35 is here formed with the conical section 36, while the transition between the threaded section 24 and the rest of the shank 14 of the screw takes place stepwise. Here too, there will be a ring-shaped contact line 37 on which the point of application 22b will be positioned. The screw will be in engagement with the building element via the threaded coupling 42.

Fig. 5 shows a screw where the threaded section 24 merges into the rest of the shank 14 of the screw with a stepwise increase in diameter. The diameter of the threaded hole 35 will be constant right out to the surface of the element, as will be seen, so that a force relieving engagement area 43 will be disc-shaped, and the actual point of application 22b will be positioned in the outer edge of the disc-shaped area 43.

Fig. 6 shows a structure corresponding to the one shown in fig. 5, where the point of application 22b is moved even further away from the longitudinal axis of the shank, the shank section 14b being provided with a ring-shaped portion 38 to increase the width of the disc-shaped engagement area 43. Here too, the screw will be attached to the threaded hole 35 of the element 30 via the threaded coupling 42. It is common to the embodiments shown in figs. 4-6 that the threaded section 24 of the shank merges into the threaded section 14 of the shank with a stepwise increase in diameter. However, it should be noted that the

shank of the screw will be weakened in this area because of notch effect.

Fig. 8 shows an alternative embodiment of the screw shown in fig. 1, where the threaded section 24 of the screw merges into the shank section 14 of the screw via a conical section 22. The building element 30, into which the screw has been screwed, has a threaded hole 35 with a likewise conical section 36. The screw is coupled with the building element 30 via the threaded coupling 42, and the additional fixing between the screw and the element is provided by a pair of locking bosses 39, which are arranged in the bottom of the threaded hole and are adapted to be received in the tip of the screw in the two locking holes 43 formed there. It is hereby ensured that the force provided by a wheel mounted on the screw does not loosen the screw from the building element 30. This might otherwise occur because of the great pitch of the thread 25. This great pitch is caused by the wish that it should be easy to mount the screw during play and that the production of the screw should be facilitated, it being possible to manufacture it by means of simple tools.

Patent Claims:

1. A screw for a toy building set and comprising a shank with a threaded section for screwing into another of the elements of the toy building set with a preformed threaded hole, said screw being adapted to resist forces acting transversely to the shank of the screw at a distance from the element, characterized in that in elongation of the threaded section the screw has an engagement area with which the screw, when screwed in, engages a complementary engagement area on the other element of the toy building set formed with a threaded hole, so that the screw is supported in an area positioned at a greater radial distance from the longitudinal axis of the screw than the radius of the threaded section.

2. A screw according to claim 1, characterized in that the engagement area of the screw forms an engagement face with the shape of an annular collar.

3. A screw according to claim 1 or 2, characterized in that the collar is formed by a continuous, conical face.

4. A screw according to claim 2 or 3, characterized in that the collar forms a transition between the threaded section with one diameter and a shank section having a diameter greater than said diameter.

5. A screw according to claims 1-4, characterized in that the engagement faces on the screw and the other element formed with the threaded hole are provided with complementary depressions and projections.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/DK 92/00321

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the Swedish Patent Office EDP file on 08/01/93
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